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FRONT COVER

Agricultural Scene in China

Farmers at work preparing a rice paddy on the west bank of Kunming Lake. The mountainous country that rims this high lake (6,200 feet) is shown in the background. (Photo by courtesy of the Chinese News Service, New York.)

BACK COVER

World Map—Prewar Rice Production

The annual average rice production of the world during 1935–39 was 7,400 million bushels. As a result of the war, the total dropped to 6,400 million bushels in 1946 but recovered to about 7,100 million bushels in 1947.

NEWS NOTES

Mr. Haggerty Attended the Bogotá Conference

John J. Haggerty, Regional Investigations Branch, OFAR, was a member, representing Agriculture, of the United States delegation to the International Conference of American States at Bogotá, Colombia.

Dr. Trotter Makes Cotton Survey

Dr. Ide P. Trotter, Agricultural Economist (Cotton Specialist), OFAR, is making a 4-month survey of important markets of the Far East for American cotton under the Research and Marketing Program of the Department of Agriculture. His itinerary includes Japan, China, India, and Pakistan.

Dr. Pendleton Returns from Siam

Robert L. Pendleton, Soil Scientist of the Technical Collaboration Branch, OFAR, has just returned to Washington after spending 3 months in Siam. He served as agricultural adviser to the Food and Agriculture Organization's mission of eight scientists sent to Siam to study ways and means of increasing rice production, improvement of rice-marketing practices and statistical services, control of rinderpest, and conservation and utilization of forests.

Director Davis Heads Texas Rice-Experiment Station

William C. Davis, formerly Director of the Instituto Agropecuario Nacional, cooperative agricultural station in Guatemala, has been placed in charge of the new rice-experiment station at Beaumont, Tex. This station, now a cooperative, has recently been greatly enlarged in scope, and included in this organization are the Division of Cereal Crops and Diseases, Division of Forage Crops, Division of Agricultural Engineering, BPISAE, ARA, USDA; the Texas A. and M. College; and the Texas Rice Improvement Association.

Illustration on page 115 is a U. S. Air Force photo, furnished by courtesy of Headquarters, U. S. A. F.

FOREIGN AGRICULTURE — HALLY H. CONRAD, EDITOR

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Rice—A World Food Crop

Rice is one of the world's primary food crops. It is the basic item in the diet of approximately one-half the world's population, and all countries consume this cereal in varying amounts.

by L. THELMA WILLAHAN

Native to monsoon climates, rice is a carbohydrate food which, for millions who live in tropical and semitropical lands, meets the nutritional needs supplied by potatoes and wheat flour to residents of temperate zones. Rice is adapted to growing conditions in hot, wet climates and keeps in storage for longer periods and in better condition than many other starchy products. It is the leading food of Asia and is an accepted staple of the peoples' diet in monsoon Africa and in tropical and subtropical countries of the Western Hemisphere.

In the total annual production of world grains, rice competes with wheat and exceeds the output of corn. The center of rice production is in Asia, that part of the world which has about one-half of the world's population, but where, before the war, only 3 percent of the world potato crop and about 25 percent of the world wheat production were harvested.

In numerous languages of the Orient, the word for rice is synonymous with food, and it is accepted as being as old as the ancient civilizations of the Asiatic Continent. In many countries, the cultural life centered for centuries around the planting and harvesting of this crop. The cycles in the rice seasons were observed with elaborate ceremonies. An illustration of interest may be quoted:

> For centuries in Siam, a high dignitary of the State, appointed by the sovereign, . . . always presided at the ceremony with great pomp and solemnity. The plough, the bullocks, and the seed were blessed by the Clergy; an auspicious triple furrow was then cut all round a field, which had been previously decorated with garlands of flowers and various charms. The earth turned up by the plow was sprinkled with lustral water; sanctified seeds were scattered to symbolize the opening of the sowing season.

From the turn of the twentieth century until World War II, the world's harvest tended to increase despite set-backs in some years. A notable expansion occurred on all the continents during the 1930's as a result of extended acreages and increased yields per acre brought about by the use of improved varieties, additional fertilizers, and the development of irrigation. The increase in output was most outstanding in China, Netherlands Indies, French Indochina, Formosa, and Japan.

During the same period, interest in the production of rice in the Western Hemisphere resulted in the planting of new areas to this crop and a larger total harvest. A perceptible rise in Egypt's production along with moderate increases in other African countries also brought about a larger outturn in Africa. Only a slight gain occurred in Europe, because civil war reduced the output of Spain.

The annual world rice production before the war (1935–39) averaged 7,400 million bushels of rough rice. For purposes of comparison, average wheat production approximated 6,000 million bushels and the annual average potato harvest, 8,400 million bushels. Rice production at that time was probably at an all-time high.

China produced one-third of the world rice crop and India, one-fourth. Japan and the Netherlands Indies ranked next in production, and all the countries of the Far East produced sizable quantities. The Philippines, Malayan Union, Ceylon, and Manchuria grew a part of their own requirements, whereas Burma, French Indochina, and Siam furnished a surplus for export.

Patterns of rice culture from the preparation of the soil for planting to the final stages of milling vary

A view from Burma Road in China, showing rice paddies and vegetable patches.

Rice seedbed suffering from drought near Manila, P. I.

from country to country and in areas within countries. Tillage practices are adapted according to the amount of rainfall, type of soils, and general topography. In illustrating a custom of one locality, therefore, the inference cannot be made that the same custom is followed in all parts of a country or continent.

The major part of the world's rice crop is cultivated by hand labor. By using modern machinery the numerous tasks involved in planting and harvesting, which are laboriously performed by hand labor in monsoon countries, are combined and rapidly executed. The use of machinery is not practicable, however, in many of the intensively cultivated rice paddies [1] of the Far East where every parcel of ground is arranged in small plots. In some areas, too, the rice in the various plots is in different stages of planting, growth, and harvest at the same time. In mountainous areas, also, as in parts of the Philippines and Netherlands Indies, where rice is grown on terraces, such machinery is not usable.

Generally speaking, rice is seeded in one of two ways, by transplanting or by broadcasting. Transplanting is the predominant method in the regions of Asia where rice is the basis of the economy. Although it requires more time and labor than broadcasting, it produces a higher yield per acre. The requirements of rough rice used for seed are considerably lower when seedlings are transplanted, and thus the percentage used for seed is kept very small.

For transplanted rice, the seed is usually first planted in seedbeds until sprouted to a stage satisfactory for setting in the rice fields. The land to which seedlings are transplanted is prepared during the time the young plants are growing in the nursery. The fields may be plowed and then harrowed several times, and when ready for the seedling transplants they should be under 2 to 4 inches of water and the soil, to the depth of 4 to 6 inches, the consistency of fine paste.

New seed may be broadcast on irrigated or on unirrigated land. That broadcast on unirrigated land is called upland rice. Growth of this usually occurs in uneven patches, the yield per acre is less, and the harvested rice is often of poorer quality than that of rice grown on irrigated land.

One primitive method of culture persists in countries of Asia, Africa, and Latin America, by which small areas of forests, jungles, or accumulated growth are burned over to provide space on which to broadcast upland rice. After one or two harvests, however, the grower abandons the land and moves on to new patches.

Planting of the crop, in the northernmost rice-producing areas of Asia, as in central China, Japan, Korea, and Manchuria, begins in April and May. Harvesting is from August to November. Generally speaking, as one travels southward toward the Equator, the dates for planting and harvesting are later. This is not strictly true, however, because the season usually starts with the beginning of the monsoon, which varies from north to south in the more tropical climates. The planting of early and late-season varieties also is customary. These different varieties mature in 2.5 to 6 months from the time of planting. The grower usually plants several varieties so that some rice will be harvested during the entire season. Thus, the harvesting of rice in the countries of Asia continues throughout a large part of the year.

[1] The term "paddy" or "padi" may refer to a rice field or to unthreshed, threshed, or rough rice.

TABLE 1.—*Average yields per acre of rough rice in specified countries of the world, 1935–39*

Country	Yields per acre	Country	Yields per acre
	Bushels		*Bushels*
Burma	27.5	British Guiana	50.8
China	52.5	Chile	99.9
Formosa	53.0	Paraguay	46.0
French Indochina	22.5	Peru	42.8
India	26.2	Surinam	46.0
Korea	51.0	Uruguay	66.6
Japan	75.8		
Malayan Union	36.3	Italy	103.9
Netherlands Indies	31.6	Portugal	68.0
Philippines	21.6	Spain	[1] 124.4
Siam	30.1		
		Belgian Congo	11.2
Cuba	21.4	Egypt	71.6
Mexico	42.2	French W. Africa	13.4
United States	49.7	Madagascar	28.3
		Sierra Leone	26.8
Argentina	59.8		
Brazil	28.6	Australia	92.0

[1] 1930–34 average.

The same method of harvesting rice that is customary throughout Asia is also commonly found in African and Latin American countries. The sickle or hand knife is used by laborers to cut the rice plants. In some countries the harvested plants are then placed on poles to dry before threshing, as in Japan; in others they are left in the field to dry, and they may even be threshed without being dried, though that practice is uneconomical.

In countries having little or no farm machinery paddy rice may be threshed by placing bunches of ears on sheets of grass matting, or on clean, baked soil, and then treading on them with the feet. In some places where the harvest is large, unthreshed rice is placed in small piles and the rough rice is tramped out by cattle. Rice may be threshed by using sticks to beat the paddy, or as one step toward mechanization with a foot-pedal thresher. The stalks may be beaten against a barrel, or other container, so that the threshed rice is received by some kind of a receptacle and, at the same time, the chaff is blown away by the wind.

The use of modern machinery in rice farming where practicable usually results in higher average yields per acre, and naturally makes possible the cultivation of larger areas, with less human effort, than when hand labor is used. Such machinery as reapers, binders, harvesters, and combines appear to be adaptable to climates outside the Tropics, where the fields are irrigated in large sections and water can be controlled in such a way as to enable free movement of such machinery.

Production with modern machinery is highly successful in the United States; in Rio Grande do Sul, the exporting State of Brazil; and in the Sonora Valley of Mexico. Rice planting by means of the airplane has been quite generally adopted in parts of California. In Italy and Egypt modern machine methods are combined with hand labor.

The yield of rice per harvested acre varies in the rice-producing countries of the world. Harvesting in the Temperate Zone countries where relatively large areas may be irrigated and modern machinery is used tends to give the highest yields per acre, but comparable yields are produced in Japan and China where increased amounts of fertilizers are applied. Generally the highest yields appear to be obtained in the areas farthest away from the Equator, where the additional sunlight of longer days promotes plant growth. (See table 1.)

World War II caused a dislocation in the rice economy of the different areas in the world. The drop in production that occurred in the occupied countries of Asia was especially serious for importing countries. At the same time, the factors which caused shortages and attendant high prices, when the export supplies of Asia were cut off, stimulated rice production in all the countries of the world outside the combat area where soils and climates were conducive to rice growing.

In the Western Hemisphere rice production nearly doubled. Increased output in some Latin American countries not only provided domestic requirements previously supplied by imports but furnished surpluses for export. These surpluses were small in relation to the prewar world rice trade but were large in comparison with total world-export availabilities. The few Latin American nations which exported before the war increased their exports, some importing countries developed their rice industries to satisfy domestic

Transplanting rice in Formosa.

requirements, and most of the other importing countries reduced substantially their import needs.

In the United States the rice acreage rose from 1,050,000 acres harvested annually during the 5 years ended in 1940 to nearly 1,700,000 acres, the 1947 record. The States of Louisiana, Arkansas, Texas, and California produced only about 1 percent of the world's total output in 1947, but, oddly, the United States that year was the world's second largest exporter of rice. This fact alone demonstrates the seriousness of the decline of rice production in those Asiatic countries that formerly supplied the rice required by other Asiatic countries which do not produce their own needs, and in which the population leans so heavily on this cereal for sustenance.

Wartime Changes in International Rice Trade

Of the prewar average annual rice production of the world only 7 percent moved in international commerce. Of that volume, 94 percent was shipped from the surplus countries of Asia, primarily to other countries of that continent (Map I). Historically, India, China, and Japan have been the largest importers as well as the leading producers.

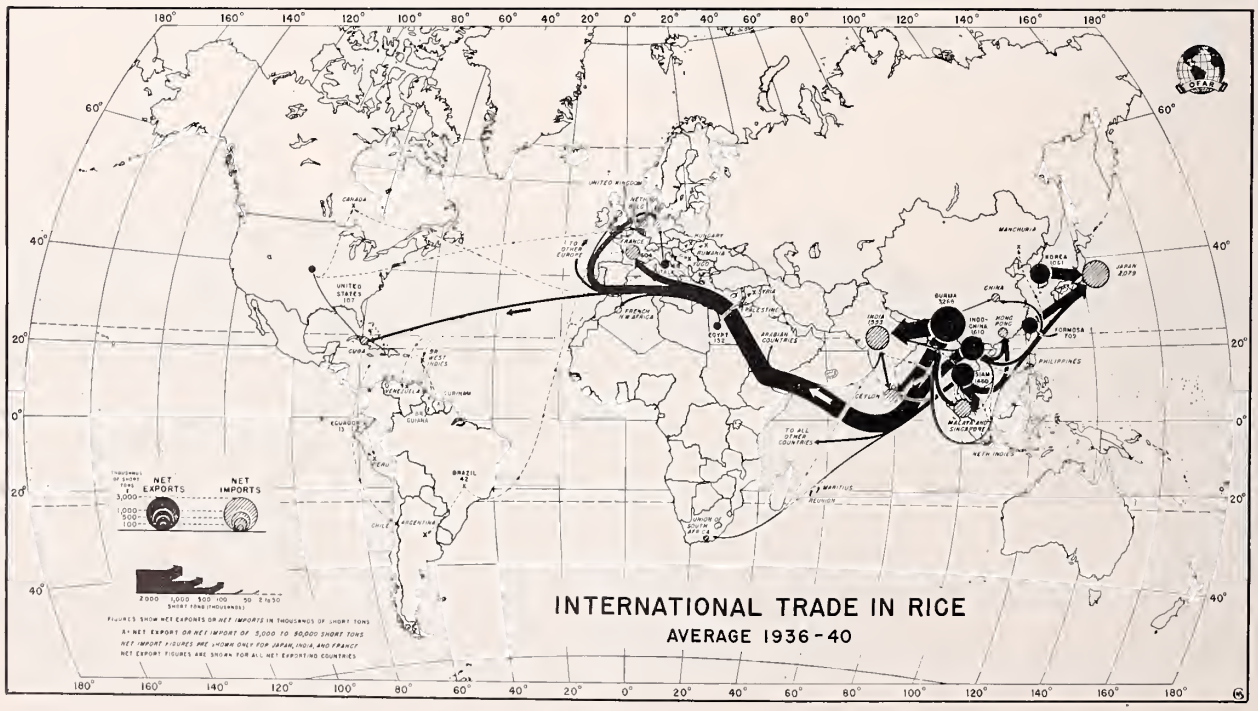
The primary export trade was centered in two areas of Asia. The world's "rice granary" was in Burma, French Indochina, and Siam—three countries grouped together between China and India. The other surplus areas were in Korea and Formosa, both Japanese colonies. Production in these colonies was increased after 1930 by Japanese authorities for the purpose of sending rice to Japan proper, and they accounted for about 20 percent of the world trade in rice.

The principal rice-exporting area of the world, the "big three," shipped about three-fourths of the rice entering international trade, or an annual average of about 6.4 million short tons, in terms of milled rice. Burma shipped 3.3 million tons; French Indochina, 1.6 million; and Siam, 1.5 million tons. In contrast, the Western Hemisphere required net imports of rice, and United States exports were extremely small.

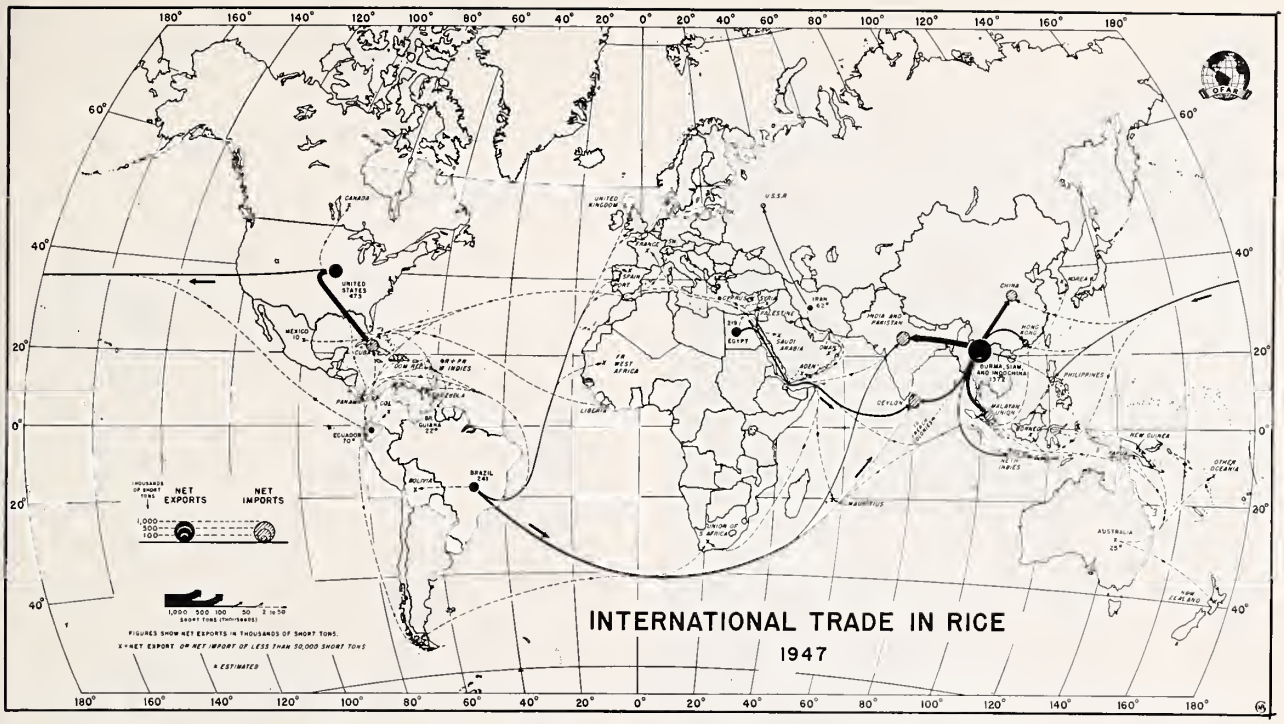
Although the greatest demand for Asia's surplus before the war was in the countries of that continent, important quantities of Asiatic rice were exported to other regions. Outside Asia, Europe was the most important market, and some went to African countries, particularly to the colonies. Several Latin American nations were also good markets.

A complete reversal occurred in the direction of the world's rice trade as a result of the war (Map II). Instead of being the main source of rice for the countries of other continents, Asia required heavy imports. The importing countries needed much more than before the war because of decreased production, and the surplus in the exporting countries of Asia was only one-fourth of that before the war.

To help alleviate the critical world shortage of rice, the largest possible volume from the expanded produc-



Map I.—The prewar export movement of rice was largely from east to west.



Map II.—The 1947 international trade in rice was only a fraction of the prewar volume and moved from west to east.

tion of Western Hemisphere countries was directed to the Orient. During the last years of the war, Western Hemisphere and Egyptian rice was delivered to India and Ceylon. Since 1945, United States rice has gone to the Netherlands Indies, the Philippines, China, and Korea. Brazilian, Ecuadoran, and Chilean rice was exported to India, Ceylon, and the Malayan Union. Egypt also supplied India and Ceylon with sizable quantities. The exports available from these countries however, represented only a small proportion of needs in Asiatic countries.

The continents of Europe and Africa since the war have received very little imported rice. Whereas Asia exported 1.3 million tons annually to Europe before the war, in 1946 and 1947 European countries were not allocated rice by the International Emergency Food Council from the world's short supplies, because all available supplies were shipped to countries having the direst need. The amount allocated to the African colonies was extremely small in relation to former imports.

Rice as a Food

All except 6 percent of the world's prewar annual rice harvest was utilized in Asia, largely for food. Three-fourths was consumed in China, India, and Japan. Per capita consumption before the war in Asiatic areas of heaviest consumption averaged from 300 to 400 pounds annually, compared with only 6 pounds in the United States.

Individual tastes of Asiatics for varieties and types of rice differ from locality to locality within the countries. Some people prefer short-grain and glutinous types; others like long-grain rice. To those who are accustomed to eating rice at most of their meals, each variety has a different flavor, and country and city consumers have decided preferences.

A high proportion of the annual harvest is kept by growers to supply their own families. The retained paddy is usually stored and milled as needed on farms, and brown rice resulting from home milling contains much more of the rice kernel than does that processed at the mills. That the bran left on brown rice contains vitamins essential to a balanced human diet is a well-established fact. Beriberi, a deficiency disease prevalent in Asia, has been proved to be the result of a lack of the proper vitamin intake, and is found principally in places where white, polished rice is the main diet.

The production and consumption of parboiled rice before the war was common in many parts of India, Malaya, and Ceylon. Parboiling before milling has

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Hanging bundles of rice up to dry near Kobe, Japan.

been proved to have several advantages over white milled rice; among them is the preservation of the food value which is inherent in rice, but which is lost in the usual milling process. In parboiling, paddy rice is steeped in hot water for several hours and then dried, the final results rendering a brittle grain which is nevertheless less susceptible to breakage in the process of milling.

In the numerous village, town, and city rice mills of Asiatic countries, the percentages of the products obtained in milling rough rice are much the same as in the United States, where about 65 percent is used for food. In Asia about 70 percent is considered edible, because about three-fourths of the annual harvest in heavy consuming countries is hand-pounded and also because a larger percentage of broken grains are used as food. During recent years, the maximum percentage of bran retained on rice in milling has been compulsory in many parts of Asia in order to save food. The amount used for industrial purposes also has necessarily decreased.

During the war when numerous requests for rice supplies from countries that were unable to procure their former requirements were made to the International Emergency Food Council (formerly the Combined Food Board), authorities on world food realized the extent to which rice supplies were necessary in the food supplies of the Allied Nations. Those who have worked on food procurement in the Far Eastern countries during and since the war have been interested in conferences by representatives of rice-producing countries, held for the purpose of bringing together and discussing mutual problems in the improvement of rice production and marketing.

Two conferences have taken place in the Far East. In May–June 1947, the first meeting of the Food and Agriculture Organization of the United Nations took place in Trivandrum, India, and more recently a conference was held in Baguio, Philippines, March 1–15, 1948.

While to date any progress made toward recovery of prewar acreage and production in Asia has been due to the solving of immediate problems in individual countries, the real benefits of these conferences may yet be evident in the gradual working out of long-time problems. Proposals were made for measures to increase production, such as by means of irrigation projects, the use of fertilizers, and improved varieties, and committees were appointed to investigate problems of production, marketing, and conservation.

The main problem of securing rice supplies to meet world needs may be solved in either of two ways: (1) Increasing production in surplus countries to make available larger imports into deficit countries; or (2) increasing production in importing countries. Of the five countries of Asia which had surpluses before the war, only two, Burma and Siam, have made sufficient recovery to have an effect on world markets for rice.

Harvesting rice with a hand sickle on Hacienda Milagro, Milagro, Ecuador.

Tomatoes From a Tree

In countries having a scarcity of fresh vegetables, plucking tomatoes from a tree in one's own yard would be a great joy and convenience. Such fruit is not, however, entirely comparable to our garden-grown tomatoes.

by E. P. HUME
and H. F. WINTERS

The tree tomato, botanically known as *Cyphomandra betacea* (Cav.) Sendt., is generally considered to be a native of Peru. The natives of Spanish-speaking countries would call it "palo de tomate" or "tomato de arbol." It is abundantly cultivated and highly esteemed in many parts of the inter-Andean regions of South America, and its fruits are among the most popular found in high, tropical localities.

Although generally unknown in the United States, the tree tomato grows in many other parts of the world. In cooler climates, it may be cultivated at sea level. In warmer countries, such as Malaya and the Philippine Islands, it grows well only at high elevations, and in Ecuador it flourishes at between 5,000 and 10,000 feet above sea level.

In Puerto Rico the plants apparently give best results in the mountain section, but satisfactory growth has been observed near Rio Piedras at an elevation of less than 100 feet. In the Toro Negro unit of the Caribbean National Forest and in a number of other hill sections of from 1,000 to 3,000 feet in altitude, the plants produce fruit without benefit of cultivation.

The plants, as they grow in Puerto Rico are woody shrubs, sometimes approaching the size of a small tree, 12 to 18 feet tall or even taller, and 2 to 4 inches in diameter near the soil surface. They tend to become smaller with increases in elevation. The cordate, ovate leaves are from 3 to 12 inches in length. The pinkish flowers, about 0.75 inch in diameter, are borne in small, axillary cymes near the ends of branches. They appear at the beginning of the rainy season, usually in April or May. The two-carpeled fruits are red to orange in color and resemble a hen's egg in size and shape, but they are more pointed. In the mountains of Puerto Rico the fruits ripen in October and remain on the tree until January.

In the Far East, where the culture of tree tomatoes is probably more extensive than anywhere else, some

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The fruits of the tree tomato are carried in small, loose clusters hanging near the ends of branches.

varieties have purple fruit. In the hill-country gardens of Ceylon, the trees are said to bear fruit almost throughout the year but chiefly from March to May. The tree grows quickly and begins to bear when 1.5 to 2 years old, but the bearing period lasts for only 5 or 6 years. Trees grown from cuttings are said to come into bearing more quickly, but propagation by seed is also satisfactory.

Most people consider the succulent, subacid fruit similar in taste to that of our garden tomato; others, however, think it resembles the gooseberry or the passion fruit. When cooked, its taste is not unlke that of apricots. The aftertaste is rather distinct and pleasant. In fact, a flavor differential exists; the meaty mesocarp, or flesh just inside the skin, has a bland cheesy flavor, whereas the watery, slightly acid pulp surrounding the seeds is quite sweet.

The fruit may be broken open and eaten raw. Some people consider it rather less satisfying in the

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raw state than other fruits, but others find it refreshing and agreeable. More often the fruit is stewed to form a conserve or "dulce." The skin, which is tougher than that of the usual garden tomato has a disagreeable flavor and should be removed. This is easily done if the fruit is immersed for a minute or two in boiling water. The seeds should also be removed from the pulp before cooking, because they are harder than those of the tomato and bitter in taste. For a preserve, the pulp should be forced through a coarse strainer before cooking with sugar, and the flavor is improved by the addition of cinnamon and salt. The fruit is often used in a sort of mixed-vegetable dish which is baked.

While popular in their original home and in many other parts of the world, tree tomatoes have not been popular in the hill country of Puerto Rico. Perhaps they have been cooked with the skins and seeds included; certainly this factor is of sufficient importance to make the difference between a desirable and an undesirable fruit.

The crop appears to have considerable value for persons living at higher elevations in warm countries, such as the upland regions of Puerto Rico, because the tree is resistant to insects and diseases and grows with little or no culture even in high-rainfall areas. Culture would undoubtedly result in greater yields, and the fruits mature at a season when few fresh-vegetable products are available. Several plants around the home could add variety to the family diet, especially since the tomato which it resembles does not thrive at the higher altitudes to which the tree tomato is best adapted.

It also might have a limited value as an export specialty if trade were developed with markets having a demand for new and unusual items.

The fruit of the tree tomato has two locules or cells containing rather large seeds.

Reading about... Foreign Agriculture

Rural Life in Argentina, by Carl C. Taylor. 464 pp., illus. Louisiana State University Press, Baton Rouge, 1948. This is one of those rare books that is readable and yet not lacking in factual and realistic information. It may be read with interest by the individual who is casually seeking information about or an understanding of Argentina, or it may be used as a comprehensive tool in the study of the country's rural people and agricultural conditions and problems.

The contents of the book may best be described by the chapter headings, which are as follows: Scenes in Various Type-Farming Areas in Argentina, the People of Argentina, Immigrants and Their Influence, Argentine Farmers and Farm People, History and Evolution of Argentine Agriculture and Rural Life, The Settling and Peopling of the Country, Ownership and Distribution of the Land, Agricultural and Cultural Regions, Rural Isolation and Communication, Rural Locality Groups and Communities, Levels and Standards of Living, The Farm Home and Family, Programs of Colonization and Resettlement, Agricultural Enlightenment and Reform, Farmers' Organizations and Farmers' Publics in Argentina, The Farmers' Place in Argentine Culture.

One is impressed with the fact that the author not only has first-hand knowledge of his subject but also a thorough acquaintance with the available literature. He excels in weaving into the book many statements and analyses of Argentineans concerning their own culture and people.

The book conveys the picture of a complex and diverse culture in such a way that the reader never feels lost in the detail or complexity. The author's principal emphasis is upon the varied agricultural population in its relation to the land and the national economy which it dominates. Especially important also is his analysis of social and economic institutions, colonization, and the nation's acute land problem.

Its great wealth of information and its clear and concise analysis make this book required reading for everyone who has a real interest in Argentina.

Mobilizing Our Science for World-Wide Cooperation

The job calls for a thorough knowledge of agriculture buttressed by imagination and statesmanship.

by C. REED HILL

World conditions point to the need for organized cooperation between ourselves and other nations. Congress appreciated this need by stimulating the possibilities of world-wide collaboration. Agriculture is necessarily an important part in this intensified effort in scientific and technical collaboration. The majority of the world's people depend on agricultural pursuits for livelihood. The need now is for more working tools—the bringing together of the Nation's resources of scientific personnel—and facilitating the placing of these where they can be most effectively utilized.

The Senate Committee on Foreign Relations, in reporting out a bill [1] to strengthen cooperative international relations, observed:

> Our foreign relations always have been, in the broad sense, a mixture of varying amounts of diplomacy, economics, social intercourse, and the diffusion of ideas. Benjamin Franklin was both cultural ambassador and diplomat. From early days, American enterprise, skill, generosity, and zeal made great contributions to the life of other nations which have also enhanced the appreciation of the United States. Frequently, this projection of the United States required no special effort on our part, either as private citizens or as a government. The projection has often been haphazard. No one can estimate fully what difference a greater amount of persistent concern might have made in our foreign affairs.

The intention of this new Congressional mandate is extremely broad: "to promote the better understanding of the United States among the peoples of the world and to strengthen cooperative international relations." The Congress spelled out the mandate by declaring:

> It is the intention of Congress that the Secretary of State shall encourage participation in carrying out the purposes of this Act by the maximum number of different private agencies in each field consistent with the present or potential market for their services in each country.

[1] Public, No. 402, 80th Cong.; See QUINCY EWING. WIDER HORIZONS FOR AGRICULTURAL COLLABORATION. Foreign Agr. 12: 76–79, illus. 1948.

It is, literally, an effort between peoples of our nation and the peoples of other nations, the governments merely facilitating the exchange of services and knowledge.

Legislative Background

A decade ago Congress legislated for a segment of foreign policy to "render closer and more effective the relationship between the American Republics." This was followed promptly by an act (Public, No. 63, 76th Cong.) authorizing the temporary detail of United States employees, possessing special qualifications, to Governments of the American Republics, the Philippines, and Liberia.

Based on the success of a decade of operations of a program of scientific and technical collaboration under this legislation, the Department of State recommended new legislation making the program worldwide. The "United States Information and Educational Exchange Act of 1948," passed by the current session of Congress and signed by the President on January 27, 1948, is an act to promote better understanding of the United States among the people of the world and to strengthen cooperative international relations. This is achieved in part by an educational exchange service with other nations.

Coordinated Federal Action

Constitutionally, responsibility for the conduct of foreign relations is vested in the President, who in May 1939 created a "Committee of Executive Departments and Independent Agencies to Consider the Question of Cooperation with the American Republics." Today, the Committee is called the Interdepartmental Committee on Scientific and Cultural Cooperation. Through this Committee, which both

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This article was made possible by funds provided through the United States Interdepartmental Committee on Scientific and Cultural Cooperation of the Department of State.

advises the Secretary of State on policy matters and carries on technical projects, exchanges, and personnel training, the program of cooperation with the American Republics draws upon the highly developed technical resources of the United States Government and of other governmental and private agencies throughout the country. The program is the product of extensive interagency consultation and review by the Department of State. The funds appropriated by Congress to the Department of State are allocated by the Department of State to the agency, public or private, best suited to carry out the specific projects needed.

An Executive Committee, drawn from the membership of the Committee as a whole, is the focus for policy and program recommendations to the Assistant Secretary of State in charge of public affairs. It coordinates foreign programs, recommends allocation of funds, and considers the action programs in relation to needs of United States foreign policy. These members are also operators of programs within the agency they represent on the Committee.

Dr. Ross E. Moore represents the Department of Agriculture as a member of the Executive Committee. He is also the Chief of the Technical Collaboration Branch of the Office of Foreign Agricultural Relations. This Office is charged by the Secretary of Agriculture with the foreign activities of the Department. The Technical Collaboration Branch is an action organization charged with the responsibility of spearheading the foreign technical-collaboration work of the Department.

Dr. Moore has brought to this work years of experience as an engineer-administrator in tropical agriculture, capped by specialization in the field of soils. His

Technician at Centro Nacional de Agronomía in El Salvador explains experimental work to visitors.

associates have had long experience in foreign operations, developed as generalists in agriculture around a nucleus of technical specialization.

Washington Organization For Technical Agricultural Collaboration

The Washington organization is kept to that minimum required to set policy, norms of program performance, and service to the field. It is organized functionally. One division plans programs and supervises field research in the natural sciences. It designs experiments to assure the quality of research work done in the field and operates as liaison with the technical bureaus of the Department, State institutions, industry, and private scientists.

Another division is concerned with the social sciences of agricultural education, agricultural economics, and rural sociology, and the extension techniques to be used in the dissemination of the research and demonstrational findings in the physical sciences.

An important function of this division is the training of foreign scientists. It is assisted in this work by designated administrators in certain technical bureaus of the Department. Persons from other countries, seeking knowledge of agricultural science and administration in the United States, may be placed in a university, assigned to technical bureaus of the Department for instruction in the practical operation of a technical service, or put in touch with American authorities in their field of interest. Señor Dr. don Julian R. Caceres, Ambassador of the Republic of Honduras to the United States, describes these scientists seeking knowledge of agriculture as the actual ambassadors of good will, since agriculture intimately touches the lives of most of the peoples of the world.

This training function also extends to systemizing the obligation of each American scientist stationed abroad to transmit his scientific knowledge and discipline to national technicians assigned to him as associates. The simple objective of this training by "working together" is to permit the assignment of the American scientist to another country as soon as the scientific work can be adequately performed by the associates he has trained.

Another Washington program division is charged with the responsibility and authority for supervision of field operations and, in particular, the fitting of the operation into the scientific life, the agricultural economy, and the public services of the foreign country.

The Washington organization also includes a corps of Field Service Consultants, who are highly trained

specialists. They spend most of their time at the field operations, with a major responsibility to increase the application of scientific knowledge to agricultural problems, by transmitting their specialized knowledge to scientists of the foreign country. In their field of specialization, they set up field research and demonstrational projects; counsel field staffs, foreign scientists, and administrators on problems in their specialty; coordinate the field work in their specialty between different field operating units; and serve as liaison with the technical bureaus of the Department, scientists of universities and State institutions, industry, and private scientists. They represent such specialized fields as soils, entomology, agricultural engineering, plant pathology, extension, rural sociology, agricultural education, and agricultural economics.

Field Operations

The Department of Agriculture has performed its field work in Latin America principally by advising and working with ministries of agriculture on improving their public services in agriculture and in establishing and maintaining joint cooperative agricultural stations.[2] Congress, in observing the result of this work in Latin America has authorized the extension of technical collaboration in agriculture to other countries of the world. Accordingly, it is planned to start operations this year in such agricultural areas as China, the Philippines, southeast Asia, the Arab countries, and the Mediterranean Basin.

Participation by American Scientists

The Congressional mandate is that the program is to be operated on a basis to "increase mutual understanding between the people of the United States and the people of other countries." Compliance with this mandate will test administrative abilities to the utmost. The fact that the agricultural services of the land-grant colleges are effectively a part of the resources available to the Department of Agriculture is of inestimable value and is being utilized. The personnel of the missions sent in 1946 to determine the potentiality of technical collaboration in the areas for new operations in the old world were largely volunteers from land-grant colleges. Such busy authorities and administrators served on these missions and are continuing their interest as the following: Dr. R. E. Buchanan of Iowa State, and Dean C. B. Hutchison of the University of California.

[2] Hepler, John V. Agricultural collaboration with foreign countries. For. Agr. 12: 14–17, illus. 1948.

A member of the U. S. Agricultural Mission to the Philippines views a native plow.

The Land-Grant College Association meeting, held in Washington last fall, took cognizance of this need. Dean Buchanan moved that a Committee of the Experiment Station Division of the Association be asked to consider the interrelationships between the Association and the Department of Agriculture to the end that the technical resources of these agencies may be husbanded and applied to the advancement of domestic agriculture and that available technical resources may be efficiently applied where most needed abroad. This motion was carried and referred to the Experiment Station Committee on Organization and Policy.

Even with the imposing reservoir of institutional strength, governmental and nongovernmental, active participation by the individual American scientists is an essential. It may range from the training of college students, both American and foreign, for careers in foreign agriculture, the use of sabbatical leave of professorial staff on foreign assignments to the capping of long service in agricultural science or administration of public service in agriculture by an assignment abroad to transmit this seasoned experience to the people of other countries who are eager to improve their standards of living by developing their agriculture.

United States agriculture can meet the requirements of the Congressional mandate to stimulate world scientific agriculture through the participation of all its institutions and the voluntary assistance of individual scientists in the discharge of this responsibility. Such an interest requires imagination and a statesmanlike appreciation of the need for American scientists to assist in this national effort.

Finland's Agriculture Looks Toward Recovery

by ERIC ENGLUND

Finland lost, as a result of the war, about all it had gained in 20 years of independence before 1939 in crop yield per acre and in cultivated land per capita. These losses lowered the food standard of the people and increased the country's dependence on imports, from about 20 to 25 percent of the higher food standard before the war to about 40 percent of the lower standard in recent years.

This dependence on imports has complicated the problem of postwar economic recovery, already made serious by many consequences of war, including not only the loss of territory, with its farm land and other natural resources, but also the reduction and impairment of transport facilities. A weakened industry has had to produce reparations goods, amounting to 17 percent of the national income in the first reparations year, 12 percent in the second, and 11 percent in the third. Somewhat under 10 percent will have to be produced in the remainder of the reparations period (up to 8 years), assuming continued economic progress with advancing national income.

In addition, industry has had to produce "free exports" to provide foreign exchange for the necessary imports, including food to meet the deficit in domestic production and many essentials for industrial output and agricultural recovery. Even with American loans, the larger food imports have put an added strain on the country's external buying power.

Finland's roads to agricultural recovery may be analyzed in the light of three interrelated sets of factors: (1) The reasons for the progress in agriculture in the years of independence until the Winter War of 1939–40; (2) the causes of the decline since that time; and (3) the main prerequisites to the restoration and future growth of production. These factors are so interrelated that chronological treatment of them is neither desirable nor feasible.

TABLE 1.—*Cultivated land and annual crop production in Finland, with comparisons, 1921–47*

Item	1921–25	1936–39	1940–44	1945	1946	1947
Cultivated land in 1,000 acres	5,125	6,420	6,195	5,851	5,861	5,888
Principal crops in 1,000 short tons:						
Bread grain [1]	493	849	597	535	538	593
Feed grain	567	852	518	370	373	449
Potatoes	655	1,474	1,047	860	979	1,204
Tame hay	2,369	3,717	2,717	2,574	2,298	1,885
All crops in—						
Millions of crop units [2]	2,200	3,760	2,540	2,235	2,148	2,212
Percent of 1921–25	100	158	103	92	88	91
Crop units per acre	429	586	410	382	366	376
Percent of 1921–25	100	138	95	89	87	89
Population in 1,000's [3]	3,468	3,854	3,917	3,993	4,053	4,100

[1] Wheat, rye, barley, peas.

[2] In computing total crop units (fodcrenheter or fodder units) the following weights in pounds equal one unit: Wheat, rye, barley, and peas 2.2; mixed grain 2.4; oats 2.6; potatoes 11.0; sugar beets 9.9; turnips 27.6; other root crops 19.8; tame hay 5.5; green forage 22.0; wild hay 6.6; sugar-beet tops 26.5; other root-crop tops 3.1; wheat and rye straw 11.0; oats, barley, and mixed grain straw 8.8, etc., for various minor crops.

[3] Population estimated as of the end of each calendar year.

Based on official statistics.

Gain, Loss, and Recovery of Acreage

In the two decades of Finland's independence up to 1940, about 1,483,000 acres were added to the cultivated area by the clearing of new land. Nearly half of this was lost by the cession of territory, including 709,000 acres of tilled land. Allowing for the increase in population since 1939, Finland's cropland per capita is back to the level of 1919 or slightly under 1.43 acres, after having reached nearly 1.66 acres per capita in 1939.

In order to regain and hold the 1939 relationship between cultivated land and population, it would be necessary to clear, first, 709,000 acres to make up for the lost territory; second, an additional 304,000 acres for the population increase since 1939; and, third, about 86,000 acres annually so long as the present population growth continues.

How long this annual land clearing should, or could, continue depends on many factors affecting future productivity of Finland's agriculture, population growth, general development in the country's economy as a whole, and public policy in reference to the level of self-sufficiency in food, compared with dependence on outside sources. (See table 1 for principal changes in Finland's crop production, cultivated land, population growth, etc., during 1921–47.)

POSSIBILITIES OF ACREAGE EXPANSION: Physical possibilities exist for large expansion of the cultivated area. This impression was gained after a tour of rural

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Finland last summer, including visits to many land clearings. Support for this impression is found in the investigations of Prof. Rurik Pihkala of the College of Agriculture, University of Helsinki, which show that there are in northern Finland about 2,965,000 acres of land suitable for clearing with the technical improvements of recent years. Similar appraisals indicate that about 1,730,000 acres are suited for clearing in central and southern Finland.

The economic possibilities of clearing and cultivating these areas, the greater parts of which lie north of the 64th parallel, depend upon many factors—scientific, technological, commercial, political—and their interrelation with the country's general economy. These are considerations for the longer future. Finland's "land hunger" is very real *now;* hence, the necessity for clearing land as rapidly as possible.

PRIVATE AND PUBLIC EFFORT JOINED: It is probably unique in history that a nation, losing in war a large part of its territory but keeping the people that lived there, has set out so purposefully to regain within its boundaries the lost acreage of cultivated land. This merits a description of the main elements of Finland's land-clearing program as part of its agricultural reconstruction.

Private and public efforts are joined for the expansion of the cultivated area. This is accomplished through governmental loans and subventions, or "benefit payments," to stimulate individual clearing of land, and through a nation-wide program of mechanized clearing by a corporation having the Government as minor stockholder, major creditor, and direct participant in the policy-determining Board of Administration.

Loans and subsidies to individuals began as early as 1928 to encourage the enlargement of smaller farms. Since the war, however, these means of enlarging the total cultivated area have been expanded to provide stimuli on a wide front. They now include varying rates of subventions and loans, not only for creating new farms and enlarging old ones but also for engineering projects to lower certain lakes and to drain marshy areas by levees, canals, and pumping plants.

Payments to individuals vary from about 80 percent of labor costs for holdings below 7.4 acres to 25 percent for those between 37 and 74 acres, with corresponding gradations for intervening size groups. The maximum of such costs at the 1947 level of prices was 8,000 to 10,000 Finn marks [1] per acre, depending on whether the fields are drained by open ditches or underground drainage.

[1] Currently the Finn mark equals about 0.74 U. S. cent.

These generalized facts, the above-mentioned engineering projects, and the mechanized clearing described hereafter indicate that recovery of the cultivated area puts a heavy strain on the available labor, the industrial capacity, and the taxpayers of Finland.

MECHANIZED CLEARING OF LAND: The Land Clearing Company, a semipublic corporation, was founded in 1940 at the instigation of the agricultural organizations under the leadership of Dr. Juho Jännes, Chairman of the Central Union of Agricultural Producers. Its purpose was to clear land with power machinery, supplementing the hand labor, the grubbing hoe, and the horse by which 1,483,000 acres had been cleared in the 20 years of Finland's independence up to the Winter War of 1939–40.

The initial capital stock of the company was 50 million Finn marks, later increased to 70 millions, and subscribed as follows, in million marks: Industrial enterprise 15.0, banks 13.0, cooperatives 10.0, insurance companies 8.5, private persons 3.5, and the Finnish Government 20.0. As the capital declined in value with the inflationary rise in prices, and in order to expand operations, the Government extended to the company a line of credit up to 450 million marks to finance the acquisition of machinery and materials.

The board of directors has seven members, of whom one is designated by the Government. There is an executive committee, and a director is in charge of operations. The country is divided into seven districts. Each district is headed by a chief of operations and subdivided into work areas, each of which is headed by a leader and supplied with tractors and related machinery. This equipment, the amount of which is as yet far below plans, is serviced by trained mechanics at company-owned tractor centers and support shops.

The chief tractor center is at Hämeenlinna, about 100 kilometers (62 miles) north of Helsinki. Another is being built for the central part of the country, and a third is to be built in northern Finland. The Hämeenlinna center has 24,756 square feet of shop floor space and is equipped with railroad sidings and cranes that handle the largest American tractors, bulldozers, and other heavy machinery, part of which is U. S. Army surplus material. It employed about 80 men in July 1947. In addition to general repair work, it made certain spare parts for American tractors when these could not be obtained from the United States.

NEED FOR MORE MACHINERY: The chief limiting factor in the company's operations has been an insufficiency of machinery, particularly of tractors and bulldozers.

After having been evacuated in 1940 at the close of the Winter War, these people are again leaving their home in surrendered Karelia, September 1944. They illustrate the main reason for Finland's land problem and colonization program.

At the close of last July, it owned 217 tractors, of which 120 were at work, 15 awaited bulldozer equipment—then on the way from the United States—and 82 were old tractors not all reparable. Nearly 200 additional American tractors were on order.

The management expects to clear 37,000 acres per year with this equipment and states that 350 additional tractors are needed, with the necessary attachments and related machinery, in order to clear about 74,000 acres per year, or the annual prewar average cleared in the old way. The "old way," stimulated by "benefit payments," no doubt will bring more new fields into cultivation and enlarge old ones, thus contributing much toward the objective of the land-clearing program.

The main task of the company is to clear land, chiefly as commissioned by the Government, for settling the population removed from the ceded territories. Clearing work is done also for the private account of settlers and for farmers to enlarge their cultivated areas. In off seasons, the company also does such work as road construction, excavation, drainage, and even snow clearance. This helps to equalize the work load by providing employment in periods when land clearing is less feasible. These types of work are more profitable than Government land clearing, which is given preference in rates of charges to keep its cost as low as possible. The company, a limited dividend concern, earned 3 percent on capital stock in 1945 and 4 percent in 1946.

EXPANSION OF OPERATIONS: The company's program is advancing by stages. In 1945 it cleared about 3,700 acres, after practically no clearing in the war years, and about twice as much in 1946. Meanwhile, some additional land was cleared by the farmers themselves, partly stimulated by the above-mentioned subventions. There is necessarily a time lag before these enlargements of the cultivated area appear in statistical records. All in all, however, about 86,500 acres were cleared in the 3 years 1945 to 1947, about one-third of the increase needed to keep up with the population growth.

Even with heavy American machines, clearing takes about 2 years from forest to partly finished fields, that is, fields that are ditched and planted on about 70 percent of the area, between windrows of uprooted stumps. On many clearings, stumps are cut for fuel, using a "stump-chopping" machine. A breaking plow of Finnish make turns a furrow 32 inches wide, unhindered even by green stumps up to a diameter of 2.8 to 3.1 inches. From 4 to 5 years are required from forest to finished fields, with stumps removed and the entire area under cultivation.

The company management is able to cite accounting reasons favoring the mechanized process, in terms of speed of getting the work done and in comparative costs in hours of labor and money outlay per acre cleared, per foot of ditch dug, and in terms of other work units.

Seeing the successive stages of this work and knowing the tedious, hard labor required to clear land in "the old way," give added reasons why mechanized land clearing has the support of the land-hungry, food-rationed Finnish people, of whom very many know what it means to lose all and to start again with only hard work and faith in "the good earth."

Gain, Loss, and Recovery of Yield

The high level of yields per acre in 1936–39—8 percent above 1921–25—was due in part, but *only in part*, to favorable weather in 1937 and 1938, particularly in the vital months of June and July. The general and basic upward trend continued into 1939, because the reasons for it, chiefly the increased use of fertilizer, were still present to influence the crop harvested in that year.

The period 1940 to 1944, on the other hand, included 3 years of relatively unfavorable weather, 1940 to 1942. They were years of low rainfall in the early summer, especially in the critical month of June. This adversely affected production in other northern countries as well as in Finland. As to the general level of total production, probably some crops are to a degree underestimated, as suggested by the official livestock committee participating in the production investigation of 1946. The committee said

that "in some instances crops are estimated altogether too cautiously."

Allowing for these considerations affecting accuracy of recorded yields, it may be granted that the years immediately before the war (1937 and 1938) were better, and 1940 to 1942 poorer, than usual. Nevertheless, the prewar rise in yield per acre was very real, owing to basic reasons, as was the wartime decline, and was not more than incidentally influenced by vagaries of weather or vicissitudes of statistics.

First-hand observations in Finland at the height of the 1947 growing season were consistent with official statistics. The author had opportunity to visit many farms in various parts of the country, walk with the farmers over their fields, see many herds and their production records, and to ask questions.

Such questions as these were frequent: What is likely to be the yield on your farm (or in this area) this year? How does it compare with last year? With prewar? The replies readily led to discussion of reasons. The answers, while hardly sufficient for independent computation of regional and national averages, were consistent with official statistics, both as to general trends since before the war and regional variations in 1947.

There were numerous conversations with many persons, including provincial governors, all vitally interested in the agriculture of their Provinces, and with other public officials, farm-organization leaders, experiment-station directors, teachers, 4–H Club leaders and members, and heads of cooperatives.

Last but not least, there were conversations with the farm women, whose part in Finland's agriculture can be adequately appreciated only by actually seeing what they do. They care for home and children, who usually are many, and tend gardens, which contribute materially to the food supply and health of their families. They also do much of the actual farm work, including chief care of livestock and much field work, especially with manpower on the farm reduced by the demands of reconstruction and industry and by war casualties. Finland's direct war losses in manpower were 85,000 killed, or over 7 percent of the "work-able" population, and tens of thousands invalided.

Research on changes in yield: Finnish research has yielded much scientific evidence bearing on changes in yield and the causes both before and after the war. Professor Paul Tuorila, agricultural chemist and physicist, and director of Finland's Agricultural Research Center at Dicursby, made an extensive analysis of the reasons for the increased yields before 1939, basing it on about 20,000 fertility tests in all parts of Finland. His conclusions are that, of the

Farmers, leaving their houses, lands, churchyards, and communities, in September 1944, journey along a forest road, headed for a new start—somewhere. Such displacement created a serious economic problem for Finland.

total increase in crop production from 1921–25 to 1936–39, 36 percent was due to expansion of acreage; that increased use of commercial fertilizer and soil-improvement measures [2] accounted for 43 percent; and that the remaining 21 percent is attributable to other factors, including improved seed and better tillage practices.

The same authority also attributes the wartime decline in yield chiefly to sharply curtailed application of fertilizer and lime and emphasizes that upon increased use of these depends in large part the restoration of prewar yield. If as much fertilizer had been applied in 1945 as in 1936–39, according to Professor Tuorila, the 1945 crop production would have been about 30 percent greater than it was; that is, it would have restored the 1945 yield to about 70 percent of the 1936–39 average.

In his plea for more fertilizer, Professor Tuorila concludes that, from the standpoint of the foreign exchange required, the advantage is nine to one in favor of fertilizer imports over imports of foodstuffs.

This suggests that, with the scheduled application of fertilizer in 1948 (table 2), and with favorable growing conditions, Finland's crop yields should get a good start in 1948 toward recovering wartime losses.

This hopeful prospect is strengthened by the increased use of lime in recent years, from 47,000 short tons in 1940 to 69,000 in 1942, and to 160,000 in 1945. The highest prewar total application was 104,000 in 1938.

TABLE 2.—*Application of commercial fertilizers per acre of cropland in Finland, 1921–48*

Period and crop	Nitrogen (N)	Phosphoric acid (P_2O_5)	Potassium oxide (K_2O)
Yearly average:	*Pounds*	*Pounds*	*Pounds*
1921–25	0.27	4.37	1.43
1926–30	1.16	9.90	4.10
1931–35	1.25	7.41	2.77
For crops harvested in:			
1939	2.77	11.60	5.44
1940	3.03	5.26	3.39
1941	3.93	4.10	9.64
1942	3.75	.54	5.62
1943	4.37	.54	9.19
1944	3.21	----	7.67
1945	1.25	.54	2.86
1946	1.25	3.48	.80
1947	1.96	12.31	8.57
1948 [1]	5.26	28.37	11.15

[1] Scheduled.—The amounts of phosphates and potash will be applied as scheduled, but the application of nitrogen will be materially reduced.

KORPELA, E. J. THE STATE OF FINNISH AGRICULTURE AT THE END OF 1947. Bank of Finland Mo. Bul. v. 21, Nos. 10–12, Oct.–Dec. 1947, and data obtained direct from the author, Executive Director of the Central Union of Agricultural Producers in Finland.

[2] In Finnish official statistics, "soil-improvement measures" include clay loam, sand, and peat applied to the fields. Of these materials nearly 15 million loads were applied in 1941, a load being about what a horse can pull on a cart or sleigh.

INFLUENCE OF DRAINAGE DITCHES: The general topography, the low level of the land surface, and the types of soil make drainage a vital and expensive part of Finland's agriculture. The less-than-normal care that could be given drainage ditches during the war undoubtedly contributed to the wartime decline in yield per acre. The following figures show that open ditches constituted nearly nine-tenths of the drainage system in 1941, a proportion that has probably not changed significantly since:

	1,000 acres	*Percent*
Unditched	430	8
Open ditches	4,858	87
Covered drains	289	5
Total	5,577	100

The nearly 5 million acres that are drained by open ditches average about 1,182 feet of ditch per acre. This cuts the already small fields into strips from 33 to 49 feet wide and presents a maintenance task averaging about 8,858 feet per adult male (15 to 64 years) in the Finnish farm population.

The question of whether this is too much ditch—about 5,577 million feet—has received close attention by specialists in Finland, as well as in Sweden where a similar situation prevails in some areas. The question involves many technical and economic problems, too complex for a general report. If one bears in mind the vital role which drainage plays in these areas in making it possible to work the fields and to get the seed into the ground early, the remark of one farmer is pertinent: "More farmers built themselves to the poorhouse than ditched themselves there."

Open ditches soon clog if neglected, as was evident in the summer of 1947. The Finns, without claiming that ditches were up to best standard before the war, cited wartime shortages of labor and of ditching plows as the principal causes of the deterioration—and "it hasn't been possible to catch up yet."

These ditches, moreover, take a very considerable land surface; the yield is usually low near the edge, weed control is more difficult, and field operation costly. But these and other costs and disadvantages must be met, to drain the land at all—unless provided with cover drains, a costly but valuable improvement.

COSTS AND ADVANTAGES OF COVERED DRAINS: The requirements of covered drains vary from 863 feet per acre of tight clay soil to about 398 feet for sandy soil. At 1947 prices they would cost about 131 to 164 marks per foot. Finnish drainage engineers estimate that 4,448,000 acres should be provided with underground drains. Adding the land which it is hoped will be

cleared, this calls for a program of underground drainage for about 6 million acres over a period of 50 years, or 124,000 acres annually, compared with 17,000 acres in 1939, so far the best performance in one year.

This suggests costs that would appear prohibitive, even to Finnish engineers and agriculturists, were it not for impressive gains on the other side of the ledger. According to Prof. Pentti Kaitera, drainage engineer, University of Helsinki, yields per hectare (2.5 acres) of tight soil may be increased in about these proportions: Potatoes and root crops 40 percent, grain 30 percent, and hay 20 percent, the percentages being somewhat less for lighter soil.

Covered drains save the surface occupied by the open ditch and its banks; result in more uniform soil moisture, earlier spring tillage, fewer weeds; and reduce loss of fertility. The saving of labor in farming operations is estimated at about 20 percent, and even more where mechanization can be applied.

Drainage has been studied carefully in Finland's agricultural research institutions and by the Drainage Association and progressive farmers. Based on their findings, a long-time program has been outlined for large-scale expansion of underground drainage. Progress in carrying it out, like so much else in basic agricultural improvement, is related to and dependent upon numerous other factors in the agricultural and general economy of Finland.

Some of these factors include the small size of most of the farms, which for some time are likely to become still smaller, as a result of land colonization; capital requirements for the drainage program; and general uncertainties for the future, including long-range prospects for agricultural prices, costs, and income.

AGE AND PRODUCTIVITY OF MEADOWS: Meadows cover about half the total area of cultivated land in Finland, and the hay crop is two-fifths of all crops, measured in feed units. In addition, meadows provide considerable grazing as well as green feed and ensilage. The productivity of meadows and the factors that determine it are, therefore, of high importance, especially with long periods of stall feeding of cattle and dependence on draft horses in the vitally important forest industry.

Age of meadows is among the factors that determine their productivity; it is a factor adversely affected by the war, and one that offers real possibilities for the restoration and further increase in quantity and feeding value of hay. Travel through rural Finland just before haying time last summer gave the author such striking evidence of this fact that the usefulness of statistics on the subject is limited almost to that of particularizing the obvious. Yet, a few figures may illustrate the nature and magnitude of the problem.

TABLE 3.—*Age of meadows in Finland in relation to yield and clover content of hay, 1947*

Years in meadow	Yield per acre	Clover content [1]
	Short tons	*Percent*
1	103	31.9
2	98	25.1
3	80	10.0
4	67	4.5
5	54	1.4

[1] Because of the severity of the winter of 1946–47, including scant snow cover, the stand of clover suffered. Hence, these percentages may be somewhat lower than if the winter had been normal.

A study, including 1,500 representative farms, by the Finnish Crop Reporting Service as reported in THE HAY CROP FROM LAST SUMMER'S MEADOWS (SKÖRDEN FRÅN SENASTE SOMMARENS SLÅTTEVALLAR), Lantmän och Andelsfolk, Helsinki, v. 20, No. 20, October 31, 1947.

The Finnish Crop Reporting Service, cooperating with owners of 1,500 representative farms, made a detailed study of the relation of age of meadows to their productivity in 1947. The data obtained (table 3) do not show to what extent these meadows were older in 1947 than if there had been no war. That they were materially older is evident from comments by Finnish farmers, and from the fact that the cropping and reseeding of meadow land during the war was delayed on account of labor shortages and lack of fertilizer, seed, and other essentials. As these shortages are met, the productivity of meadows will advance.

Pastures in Finland, as in many other countries, are regarded by specialists as among the more neglected parts of agriculture. Research points to large possibilities for greater carrying capacity of grazing lands and gradual withdrawal of grazing from forest areas, to the advantage of both animal husbandry and forestry.

PROSPECTIVE 1948 PRODUCTION: Good prospects for 1948 indicate that the slightly higher level of crop production in 1947, compared with 1946, probably marked the real turn from the postwar low. It was announced on March 17 that the crop of 1948 probably would average fully a fourth larger than in 1947, assuming reasonably favorable weather. This would mean an increase in bread grain of about 44,000 short tons, feed grain 187,000, potatoes 276,000, and root crops 143,000 tons over 1947. In terms of crop units, it would raise total production to 75 percent and average production per acre to about 80 percent of the record 1936–39 level.

This prognostication was worked out by the Production Division of the Ministry of Agriculture and announced on March 17 by the chief of that division,

Mr. Hans Perttula, who undoubtedly based the forecast, not only on present general current statistics, but also on past investigations of the relation of fertilizer to crop yield, such as those of Professor Tuorila. This is mentioned to emphasize again the dependence of yield on commercial fertilizer, and to illustrate the fact that research over the past decades has given the Finns many facts and relationships to guide their work toward agricultural recovery.

Livestock Numbers, Products, and Prices

Livestock production has been reduced by the curtailment of land area and lower yields per hectare; but the effect has appeared less marked in livestock numbers (table 4) than in the recorded output of animal products. It is easier, for example, to maintain the numbers of dairy cows than the yield per head, by feeding more of inferior roughage and less of concentrates when the feed situation compels it.

Statistical material is available over many years on the amounts and combinations of feed, forage, and pasture for dairy cows in Finland. Records of the cow-testing associations, with total cow numbers varying between 200,000 and 300,000, show the amounts of various feeds, yields of milk, butterfat, etc., per cow. They also show a reduction in oil cake fed per cow from 134 feed units in 1933–38 to 15.5 units in 1940–44. Total feed units, including hay and pasture, meanwhile declined from 2,133 to 1,857. Other concentrates were also greatly reduced, although not in the same proportion. Meanwhile, the clover content of hay has declined, as already indicated.

Average milk production per cow in the associations declined from 6,276 pounds in 1938–39 to 4,802 in 1944–45 and then advanced to 5,000 in 1946–47. The butterfat content has been relatively stable for about 15 years, near 4.1 percent.

These data and the record of imports of concentrates in recent years, compared with prewar, together with field observations of last summer, plainly indicate the reasons for the decline in yield of milk, as well as the factors on which recovery in milk production per cow depends, namely, more and better feed and hay.

The lesser decline in animal numbers is explained partly by a traditional inclination to maintain animal numbers as long as possible. Traveling through the countryside in early summer, especially in the northern parts, one gets the impression that the cattle, recently turned out, came through the winter too thin and that the available feed and forage, in many

A 4-H Club girl, showing her cucumber beds, in Tornio Vallue, about 18.5 miles south of the Arctic Circle.

cases, would have yielded more milk if fed to fewer cows. As in other parts of the world, a larger number is said to mean more prestige, even if less milk, "a five-cow man" standing a bit higher than one with three or four.

INFLATION AND LIVESTOCK PRICES: More important explanations, as far as Finland is concerned, probably are that livestock is a hedge against inflation and that prices of livestock products have risen far more than prices of marketable crops, chiefly grain. This difference and the general inflation conspire to shift the pattern of production toward livestock products.

The possible effect of inflation on the pattern of production may be inferred from the fact that, while general wholesale and crop prices have doubled since 1944, prices of livestock products have increased more than fourfold! In other words, the rate of advance in prices of livestock products was fully twice that of crop prices. If this should persist, the normal relationship of price patterns to shifts in production would reduce the production of market crops, chiefly grain, and increase the output of animal products. Despite the rise in farm prices, Finnish farmers do not regard their occupation as particularly profitable and often point out that productivity of land and livestock has declined, that wages of farm labor and other costs have advanced, and that farm labor is scarce.

Some General Problems of Agricultural Recovery

The two main roads to Finland's agricultural recovery—expansion of cultivated area and restoration of yield per acre—are not likely to afford smooth traveling all the way. One of the many practical difficulties, often emphasized by the Finns themselves, is that fragmentation of farms under the colonization pro-

Hay placed on sharpened poles, with cross pegs, to hold it off the ground, at the agricultural experiment station, Maaninka, central Finland.

gram is retarding the recovery of agricultural production, especially of the market supply, which has declined somewhat more than total production.

It is officially estimated that the average size of farms of more than 247 acres will be reduced from 423 acres of cultivated land before colonization to 269 after, and farms in the size group 124 to 247 acres from an average of 163 to 124 acres. The average size of smaller holdings, down to about 37 acres, also will be reduced, but at a declining percentage.

These averages illustrate something of the subdivision of farms in Finland under the colonization program, but, for various reasons, they conceal many significant elements in the progression and possible effects of that subdivision. Some of these reasons are of a statistical character, whereas others are due to differences among the various categories of owners in respect of their obligation under the law to give up varying proportions of their holdings.

From the standpoint of the bearing of size of holdings on market supply of farm products and on efficiency in farming, including possibilities of mechanized operations, perhaps a more significant factor is the total amount of cultivated land in various size groups down to 62 acres *before* and *after* colonization:

Size in acres	Before colonization *1,000 acres*	After colonization *1,000 acres*
Over 247	309	131
124–247	410	262
62–124	1,013	892
37–62	1,164	1,151

Since Finland is already a country of predominantly small farms, this fragmentation of holdings will retard mechanization and make farming less efficient. It is estimated that one effect will be to increase the average labor requirements by about 10 percent.

The following figures show the 11 size groups into which farms are officially classified, as of 1941:

Acres of cultivated land	*Percent of all farms*	*Percent of cultivated land*
Less than 12	51	14
12 up to 37	35	38
37 up to 124	13	37
124 and over	1	11

Since the Land Acquisition Act went into effect July 1, 1945, and until October 31, 1947, about 561,000 acres of tilled or tillable land and several times this amount of pasture and forest land have been surrendered for colonization. Nearly 24,000 farms and 11,000 part-time farms were created, largely for farmers from the ceded territories, who are the largest class of persons entitled to land under the act.

With a few more thousand farms in the making, the settlement of displaced farmers is entering its final stage. But land clearing to supplement these holdings, and to re-enlarge those that have lost a part of their acreage, and the construction of houses, barns, and other buildings and improvements are among the tasks for many years ahead.

A visit to the farms that have been subdivided into small holdings soon suggests the effect on production. For example, one of the larger farms which the author visited had a modern barn in which about half the stalls were empty. New farm buildings, including houses, were being built on fields that had yielded feed, hay, and pasture for a fine dairy herd. This had impaired the land base of an efficiently operated farm business that had been producing whole milk for the city population. Large economic values in buildings, fences, equipment, management, etc., were being lost, productive efficiency sacrificed, and large demands put on the national economy to build anew.

"After years of building up this farm, it must be hard to see all this happen," said the author.

"Yes, but it is hard for them, too—they are good people," replied the owner, with a gesture of his hand

TABLE 4.—*Livestock numbers in Finland, specified years*

Kinds	1939 [1]	1945	1947
	Thousands	*Thousands*	*Thousands*
Horses	388	385	404
Cows	1,378	1,121	1,074
Young cattle	540	552	478
Sheep	1,000	1,015	982
Hogs	519	229	335
Poultry	2,765	993	1,446

[1] Livestock numbers in 1939 were higher than in later years, partly for the reason that before 1941 the data included the relatively small number of animals in town and borough communes. Beginning in 1941, only those on farms were included. More important, statistically, is the fact that, up to and including 1940, the data are as of Sept. 1, whereas beginning in 1941, they are as of Mar. 1. Numbers, especially of hogs and poultry, normally decline between these dates.

toward the houses under construction for his new neighbors.

NECESSITY FOR THE COLONIZATION PROGRAM: Along with the economic disadvantage of the colonization program, it is well to remember the economic, human, and political necessity that confronted the Finnish nation at the close of the war. It was necessary to settle 374,000 persons from the ceded territories, among whom were over 175,000 farm people who had lost 709,000 acres of cultivated land and much forest land besides, some driving their cattle with them, others escaping with hardly more than what they could carry on their backs. The author visited many families, heard something of the story of their escape and their losses, and saw on their new homesteads much evidence back of the words, "it is hard for them, too."

AGRICULTURE AND GENERAL RECOVERY: Numerous other "rough spots" could be pointed out in the road to Finland's agricultural recovery. These would include the land hunger, created by food shortage, inflation, and other uncertainties, that added impetus to land fragmentation; the factors that limit industrial production for domestic needs; and production for export upon which Finland's imports depend. All these, and many more, are interdependent with the recovery of agriculture, especially in a country with half its population employed in farming and one-third of its economic life normally dependent on foreign trade. This trade depends for its raw material chiefly on Finland's forests where the work is done by men and horses that are fed largely on the products of about 280,000 farms averaging hardly 20 acres of cultivated land.

Prospects for Recovery

Recognizing the difficulties involved, it is the author's conviction, based in large part on last summer's first-hand observations, that prospects are good for the recovery and further growth of Finland's agriculture, if the country is left with a fair chance to work out its economic problems.

Perhaps a few "impressionistic conclusions," without citing statistics, may be permitted one who had this opportunity of observation in Finland, against the background of farm experience and 25 years of participation in the work of the United States Department of Agriculture, the State agricultural colleges, and experiment stations.

Finland's present agricultural research system, founded in the two decades of independence between the great wars, is definitely intact. It functions, despite wartime reverses, including budgetary problems in a time of war and inflation, loss of personnel, a gap of several years in the training of new workers, and a period of reduced contact with the outside world of research.

The scientific work, which contributed so much in the years of agricultural advance before the war, is able to give strong support to postwar recovery and growth. Most important is the general quality of the research workers. Their scientific attitude, confidence in the practical value of results, vigor and youthful enthusiasm in their work are impressive to an outside observer.

The same is true of agricultural education. The 4–H Club work, with about 170,000 members, goes forward with energy and enthusiasm even far above the Arctic Circle. Schools of agriculture and household arts develop local leaders, farmers, and homemakers in all parts of the country, even in Lappland where their work, in one school visited, was conducted in a few small rooms on the second floor of a farmhouse, pending the construction of more suitable quarters to take the place of those destroyed by the retreating German Army.

The graduates in agriculture, of the Central Agricultural College in Helsinki, include a larger proportion of women than in most other countries. In Finland, women do a large share of what is elsewhere called "the man's part of farming," and this applies to professional training as well as to the tending of gardens and the caring for livestock.

The agricultural-economy societies, lately celebrating their 150th anniversary, carry on both educational and investigational work. The economic, occupational, and political organizations of agriculture function not only in "their own fields" but also in the councils of the nation.

Also noteworthy among those engaged in these activities is a strong confidence that the basic institutions of their country and its natural and human resources are adequate to meet the country's internal problems and to accomplish reconstruction and further growth—if Finland is permitted to live in peace and independence.

The Market for United Fresh Fruit in Postwar Europe, by F. A. Motz. Foreign Agr. Circ. FDAP 1–48, 21 pp. Issued by the Office of Foreign Agricultural

Relations, Washington, D. C., April 22, 1948. In line with provisions of the Research and Marketing Act, and at the request of industry, specialists are studying, first hand, the possibilities for major United States agricultural commodities in foreign markets. This circular is a summation of personal observations on the market outlook for United States fruit in Western Europe. Reports by other commodity specialists will be issued as their surveys are completed.

PAPAYA

The papaya (*Carica papaya*), a large treelike, herbaceous plant, produces an edible fruit that resembles a melon, particularly a cantaloup. It is indigenous to tropical America but has spread to many other parts of the Tropics and as far north as latitude 32°.

The plant reaches a height of 25 or 30 feet, looks something like a palm, to which it is not related, and usually is without branches. The large, deeply lobed leaves are generally borne near the apex; the fruits are clustered near the leaf stems close to the woody, grayish trunk.

Papaya trees or plants are easily propagated from seed and grow rapidly. They begin to bear fruit within 10 to 14 months after germination of the seed but live only 4 or 5 years. They give best results in regions having a warm climate and deep, well-drained loamy soils. Cool nights and excessive moisture, even in tropical areas, are often unfavorable factors.

Papayas now grow in India, Ceylon, the Malay Archipelago, and tropical regions of Africa and Australia, as well as in Central and South America, Mexico, the Caribbean area, Hawaii, and such parts of the United States as southern Florida, Texas, and California. In most producing countries the fruit is highly prized. Like the cantaloup, it is served fresh for breakfast; and, mixed with other fruits, it is used for salads and fruit cocktails. The juice is bottled, and the pulp is prepared in various ways.

In addition to its appeal to the appetite, the fruit is a source of A, C, and other vitamins. Also, both the fruit—particularly the seed—and the leaves contain a substance similar to pepsin, known as papain, which aids digestion and has a tenderizing effect on meats. The United States imports papain in relatively large quantities. Such imports amounted to 334,000 pounds in 1947. The greater part came from British East Africa, but Ceylon also contributed a significant share. Papain is utilized commercially in medicinal preparations for digestive ailments and in "tenderizers" for tough meats.

INTERNATIONAL *Agricultural News*

Department Representatives Report on Cotton Meeting in Egypt

Representatives of the Department of Agriculture at the Seventh Meeting of the International Cotton Advisory Committee included E. D. White, Assistant to the Secretary of Agriculture, as Head of the Delegation; A. W. Palmer, Head, Division of Cotton and Other Vegetable Fibers, OFAR; and C. D. Walker, Chief, Cotton Branch, PMA.

This was the first meeting of the Committee to be held outside the United States. The opening session was in Cairo on April 1, and the meeting closed in Alexandria on April 8. Fifty-two delegates of nineteen member governments reviewed the world position of cotton in detail and exchanged statements on cotton problems and policies in their respective countries. Strong impetus was given to the movement to build up statistical services in the member countries with a view of making possible more exact appraisals of current world conditions at all times. Questions of policy were referred to a new Standing Committee which is to replace the Executive Committee as the agency for carrying forward activities in the intervals between meetings of the Plenary Committee.

The occasion was especially notable for the hospitality of the host Government, which in numerous delightful ways high-lighted the interest of Egypt in the Committee's proceedings. The meeting was opened for the king by H. R. H. the Prince Mohammed Ali Tewfik. The Egyptian delegation was headed by the Prime Minister Nokrashy Pasha, and the meetings were presided over by the Under Secretary of State for Finance, Osman Abaza Bey.

It was agreed to hold the Eighth Meeting in Belgium. E. D. White, United States, was elected Chairman of the Standing Committee to serve until that time.

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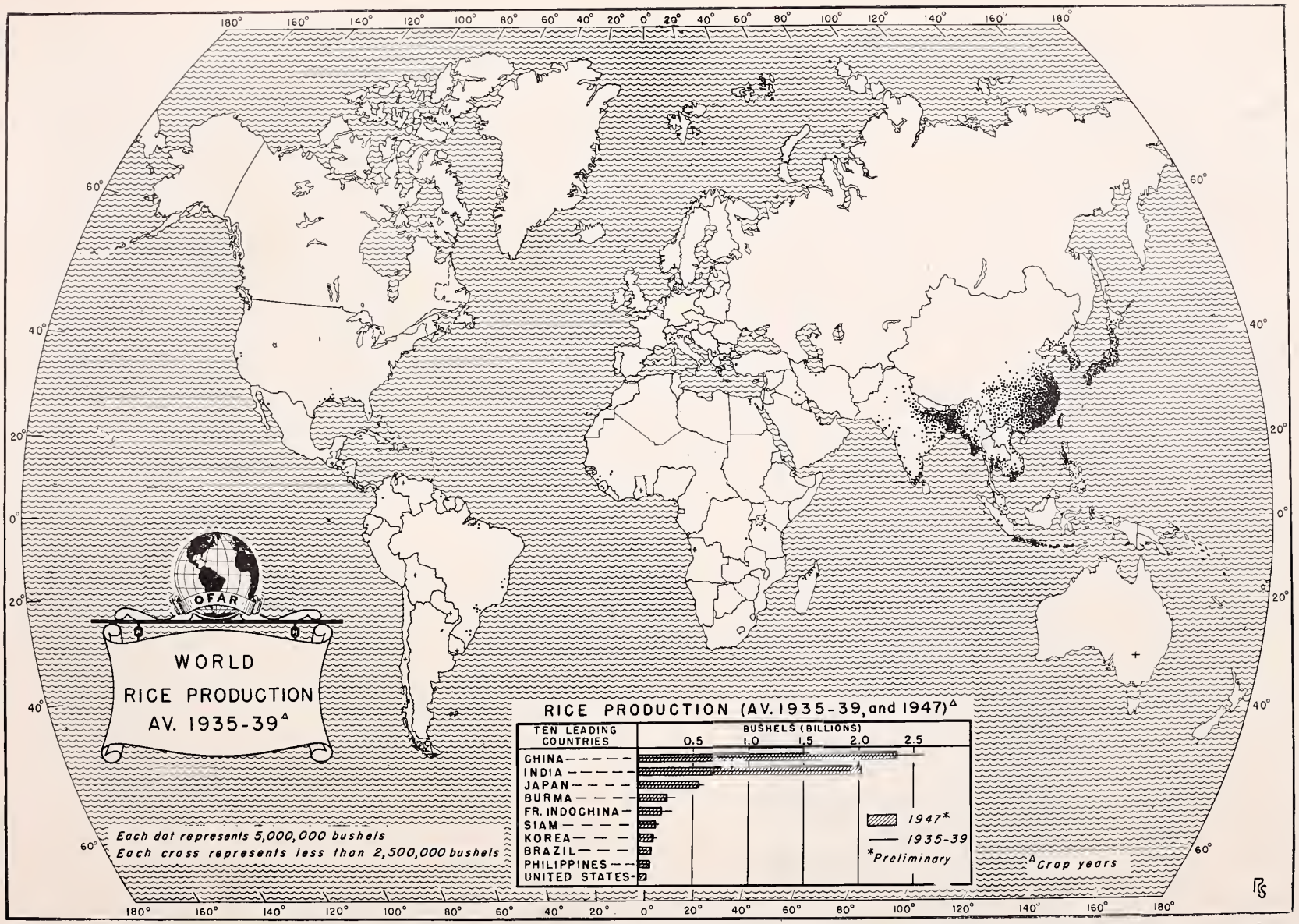

Annual world rice production during 1935–39 averaged 7,400 million bushels, produced in the areas indicated on the map by dots and crosses. On the chart inset, 1947 production is shown by a hatched bar and the average prewar output by a thin solid line. India was the only major producing country whose 1947 crop exceeded the prewar average. The total world crop was about 96 percent of prewar production.